Glucose Intolerance and Associated Factors in the Fergana Valley, Uzbekistan

H. King*[1], B. Abdullaev[2], S. Djumaeva[3], V. Nikitin[3], L. Ashworth[4], M. Gacic Dobo[1]

[1]*Division of Noncommunicable Diseases, World Health Organization, Geneva, Switzerland*
[2]*Endocrinology Dispensary, Ministry of Health, Fergana, Uzbekistan*
[3]*Novo Nordisk A/S, Tashkent, Uzbekistan*
[4]*Department of Medicine, University of Newcastle upon Tyne, Newcastle upon Tyne, UK*

Prevalence of glucose intolerance and other noncommunicable diseases has been examined in subjects aged 35 years and over in semirural and urban communities in the Fergana Valley in the eastern part of Uzbekistan, Central Asia. Diabetes and impaired glucose tolerance (IGT) were diagnosed according to the recommendations of the latest WHO Study Group on diabetes. Crude prevalence of diabetes was 9 % and 5 %, respectively, in semirural men and women, 13 % and 9 % in urban men and women. Crude prevalence of impaired glucose tolerance (IGT) was 6 % and 9 %, respectively, in semirural men and women, 9 % and 8 % in urban men and women. After adjustment for non-response, prevalence of diabetes was 5 % and 4 %, respectively, in semirural men and women and 8 % in both urban men and women. Adjusted prevalence of IGT was 4 % and 8 %, respectively, in semirural men and women, 5 % and 6 % in urban men and women. The majority of subjects with a prior diagnosis of diabetes were being treated with oral hypoglycaemic agents. Almost one-half of subjects in both communities had body mass index of 25 kg m^{-2} or greater. Central obesity (waist–hip ratio 0.95 or greater for men, 0.85 or greater for women) was observed in over one-quarter of subjects in both communities. Clinical hypertension was not frequent by international standards (9 % in semirural subjects and 13 % in urban subjects) but a number of subjects who were clinically normotensive claimed to be taking antihypertensive medication. It is concluded that glucose intolerance and central obesity are common in this region of Uzbekistan, about which there was previously little information. © 1998 John Wiley & Sons, Ltd.

Diabet. Med. 15: 1052–1062 (1998)

KEY WORDS diabetes mellitus; impaired glucose tolerance; central obesity; hypertension; epidemiology; Uzbekistan; Central Asia

Received 24 September 1997; revised 2 February 1998; accepted 7 April 1998

Introduction

In the past few years epidemiological field surveys which have used standardized study methods and diagnostic criteria have provided a wealth of information about the prevalence of diabetes in adults in diverse populations worldwide.[1] They have also highlighted a remarkable variation in the frequency of glucose intolerance, and its association with ethnicity, socioeconomic status, and other environmental factors. A part of the world where our knowledge of diabetes epidemiology remains poor is the former Soviet region of Central Asia, for which no such publications have appeared in the international literature. Since this large region, with more than 50 million inhabitants, borders both high and low prevalence areas for diabetes (the Indian Subcontinent and China, respectively) the epidemiology of diabetes in this region has also been particularly difficult to predict. Now, for the first time in the post-Soviet era, field surveys have been performed in Central Asia, which have examined glucose intolerance and associated factors in valid population samples using standard WHO methodology.

Patients and Methods

Of the five former Soviet republics of Central Asia, Uzbekistan is the most populous, with an estimated 23 million inhabitants in 1996.[2] It is also the second largest, and the most central. It shares borders with the four other Central Asian Republics, and Afghanistan. Approximately 60 % of the population lives in a rural environment. The Fergana Basin is a large area lying in the east of the country and extending into both Kyrgyzstan and Tajikistan (Figure 1). The economy of the region is mixed, since it is one of the most fertile regions of Central Asia, but during the Soviet era it was also developed industrially. Central Asia is one of the world's great crossroads, and

* Correspondence to: Dr Hilary King, Division of Noncommunicable Diseases/DIA, CH-1211 Geneva 27, Switzerland

 CCC 0742–3071/98/121052–11$17.50
© 1998 John Wiley & Sons, Ltd.

Figure 1. Map of Central Asia. The position of the Fergana Valley is indicated by the arrow

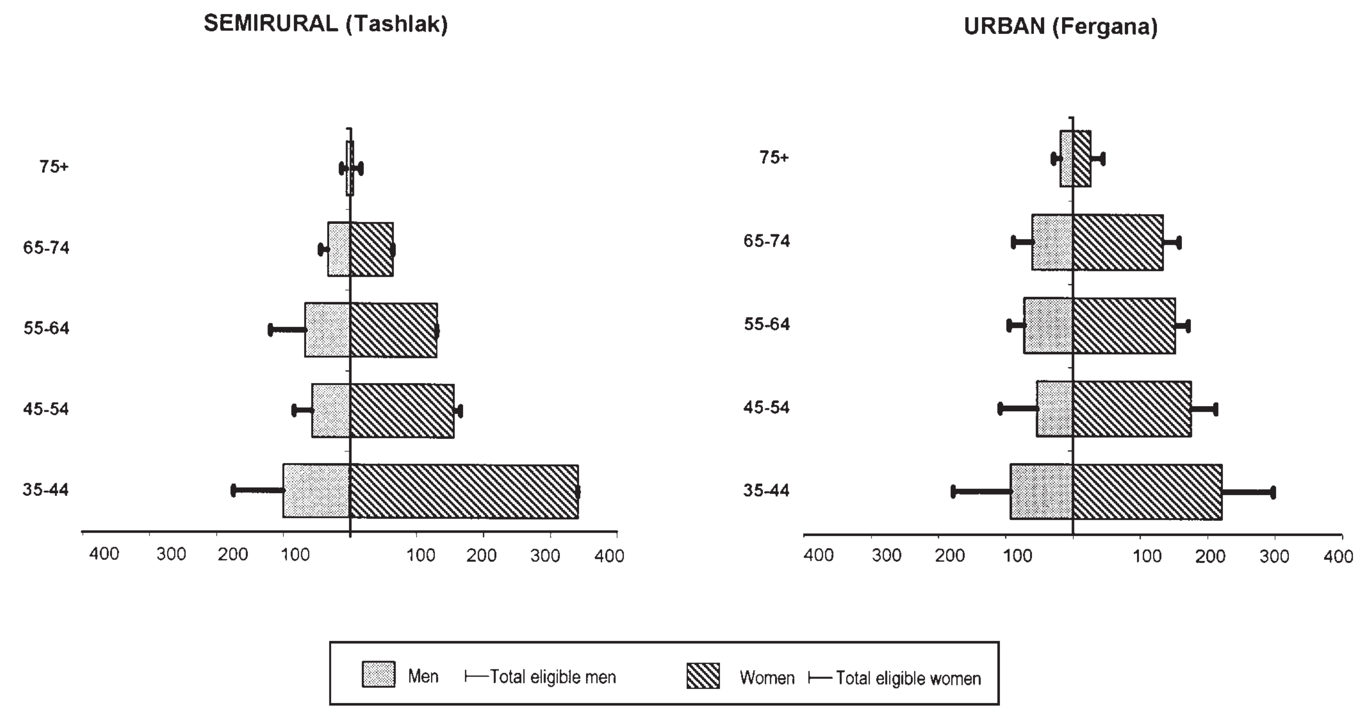

Figure 2. Age structures of the eligible populations and of the survey responders, Fergana Valley, Uzbekistan, 1996–97

© 1998 John Wiley & Sons, Ltd.

Table 1. Number of subjects, prevalence of diabetes, number of new cases and prevalence of impaired glucose tolerance (IGT), by age and sex, Fergana Valley, Uzbekistan, 1996–97. Prevalence rate adjusted for non-response is shown in parentheses

Age (yr)	Men				Women			
	n	Prevalence (%) with diabetes	Number of new cases	Prevalence (%) with IGT	*n*	Prevalence (%) with diabetes	Number of new cases	Prevalence (%) with IGT
Semirural (Tashlak)								
35–44	100	1 (1)	0	4 (2)	341	1 (1)	2	5 (5)
45–54	57	11 (7)	4	4 (2)	156	6 (6)	3	10 (9)
55–64	68	15 (8)	6	6 (3)	130	8 (8)	7	15 (15)
65+	40	15 (10)	2	18 (12)	60	10 (9)	3	13 (12)
All ages	265	9 (5)	12	6 (4)	687	5 (4)	15	9 (8)
Age-standardized[a] (95 % CI)		8.5 (4.7, 12.3)		3.7 (1.4, 6.0)		5.1 (3.1, 7.2)		9.3 (6.8, 11.9)
Urban (Fergana)								
35–44	92	5 (3)	2	1 (1)	221	1 (1)	0	5 (3)
45–54	53	15 (7)	0	15 (7)	175	10 (8)	4	6 (5)
55–64	72	17 (13)	3	11 (8)	152	16 (15)	4	8 (7)
65+	80	16 (11)	4	11 (8)	159	15 (12)	5	15 (12)
All ages	297	13 (8)	9	9 (5)	707	10 (8)	13	8 (6)
Age-standardized[a] (95 % CI)		12.7 (7.9, 17.6)		8.4 (4.4, 12.3)		8.4 (6.1, 10.7)		5.6 (3.7, 7.5)

[a]In the age range 30–64 years, using the world population by Segi as the standard.[1]
CI, confidence interval.

ancient trade routes from Europe and the Middle East to China (the so-called 'Silk Road') passed through the region. However, marriage to foreigners was discouraged in the Fergana Valley in historical times, although there are some ethnic ties between Fergana residents and Moslem communities in Western China.

The physical environment and ethnic composition of the region was considered by the national authorities to offer the best single representation of the county as a whole, which was why it was chosen for the surveys. The total population of the Fergana region is approximately 2.5 million, among whom there are 2.2 million Uzbeks, 91 000 Russians, 75 000 Koreans, 53 000 Kyrghyzs and smaller numbers of Tadjiks, Tartars, and Ukrainians.

The semirural village of Tashlak, approximately 20 km from the provincial capital of Fergana, was chosen for the first survey. An area served by one health centre was selected to be studied in its entirety. A house-to-house census was performed prior to the survey. All residents aged 35 years and over were listed by household and street—family and given names, sex and date of birth being recorded. This list was used to prepare invitations to the survey and to monitor response. Subjects were invited to attend on a specified day during a 2-week period, in June–July 1996.

An urban sample was drawn from a suitably sized section of Fergana, which is a socioculturally and economically homogeneous city, using the same sampling and recruitment procedure. The second survey was undertaken during a 2-week period in May–June 1997.

At Tashlak, a sanitorium for medical staff was used as the survey site. In Fergana, a section of a district hospital was used. A team of local medical and paramedical staff were recruited separately for each survey, selection being on the basis of assessed professional performance. Each team was trained in survey procedures and supervised by the authors.

Subjects arrived at the site early in the morning (6–8 am) after an overnight fast of 8–14 h. After registration, they were given 82.5 g of dextrose monohydrate (equivalent to 75 g of pure glucose) dissolved in 250 mg water. Subjects currently taking regular oral hypoglycaemic agents or insulin were considered to be diabetic, and were not given the glucose challenge. For those with a prior diagnosis of diabetes who were not on current medication, the fasting capillary blood glucose value was measured. If diagnostic for diabetes, they were excluded from further glucose tolerance testing, otherwise, they were given the oral challenge.

Height was measured with a stadiometer to the nearest cm, weight was measured in light clothing and without shoes, to the nearest 100 g, using a beam balance checked daily for accuracy. Waist and hip circumferences were measured to the nearest cm using a flexible tape measure. Blood pressure was measured to the nearest mmHg on the right arm with the subject seated, after at least 10 min rest, using a standard mercury sphygmomanometer. A short medical questionnaire was administered orally by trained nursing staff. Physical activity was graded for both working and leisure time according to an ordinal scale of 1–4, corresponding to sedentary, light, moderate and heavy habitual exercise. Family history of diabetes in first degree relatives was also recorded. For those with a prior diagnosis of diabetes, details of current drug treatment were recorded.

Two hours after the glucose drink had been taken,

© 1998 John Wiley & Sons, Ltd.

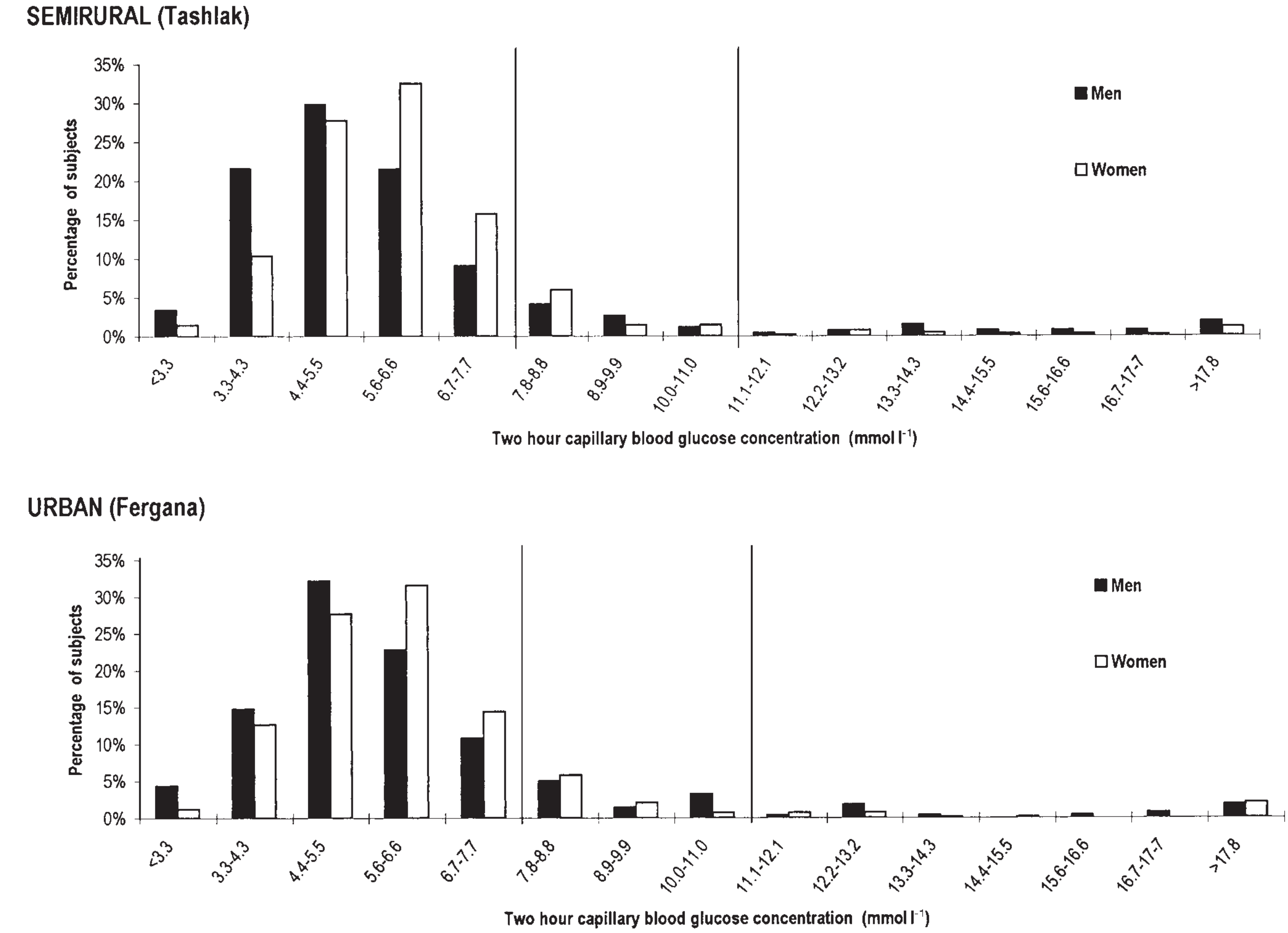

Figure 3. Distributions of 2-h capillary blood glucose concentration, Fergana Valley, Uzbekistan, 1996–97

capillary, whole blood glucose concentration was measured using a HemoCue blood glucose analyzer (HemoCue AB, Box 1204, 26223 Ängelholm, Sweden) which uses a glucose dehydrogenase method. The instrument was checked, alternatively with normal and high standard solutions, after every 20 samples. All control values lay within the range recommended by the manufacturer.

Statistical Analyses

Data were entered each day into a personal computer and were checked for range and consistency. This process, as well as the data analysis, was performed using Epi Info Version 5 software.[3] Diabetes and impaired glucose tolerance (IGT) were diagnosed on the basis of the recommendations of the latest WHO technical report on diabetes[4] which recommends 7.8 mmol l^{-1} (140 mg dl^{-1}) and 11.1 mmol l^{-1} (200 mg dl^{-1}) as cutpoints of the 2-h capillary blood glucose concentration. Body mass index (BMI) was calculated as weight divided by the square of height (kg m^{-2}). Central obesity was defined as waist–hip ratio (WHR) 0.95 and above for men and 0.85 and above for women. Blood pressure was calculated as the mean of two readings. Clinical hypertension was defined as systolic blood pressure greater than, or equal to, 160 mmHg and/or diastolic blood pressure greater than, or equal to, 95 mmHg. Subjects who were clinically normotensive, but claimed to be taking antihypertensive treatment, were considered separately.

The statistical significance of group means was assessed by *z*-test and that of proportions by the χ^2 test.

Results

At Tashlak, a total of 1144 eligible subjects aged 35 years and above were invited to attend the survey. Of these, 952 completed the examination, a response rate of 83 %. At Fergana, there was a total eligible population of 1380, of whom 1004 attended, a response rate of 73 %. The age structures of the responders and the total eligible populations are shown in Figure 2. Response rate was lowest in the younger age ranges and particularly for males. Such a pattern can inflate prevalence estimates which were therefore adjusted for non-response. This was done by using the total eligible population, rather than the survey responders, as the denominator. It is also evident that women outnumbered men in these

© 1998 John Wiley & Sons, Ltd.

Table 2. Means (95 % confidence interval) and proportions (%) of selected factors in men and women with normal glucose tolerance, impaired glucose tolerance, and diabetes mellitus, in the semirural (Tashlak) population, Uzbekistan, 1996

Variable	Normal glucose tolerance		Impaired glucose tolerance		Diabetes mellitus		Total	
Men								
Number examined	225		17		23		265	
Age (yr)	49.4	(47.9,51.0)	56.3	(50.2,62.4)	58.0	(54.9,61.2)	50.6	(49.2,52.1)
BMI (kg m^{-2})	24.7	(24.1,25.3)	25.4	(22.5,28.3)	27.7	(25.9,29.6)	25.0	(24.4,25.6)
WHR	0.91	(0.89,0.92)	0.91	(0.88,0.94)	0.94	(0.91,0.97)	0.91	(0.9,0.92)
Systolic BP	122.5	(120.3,124)	123.5	(112.4,134.5)	132.6	122,143.2)	123.4	(121.2,125.6)
Diastolic BP	75.4	(74.0,76.8)	77.6	(71.9,83.4)	82.1	(77.6,86.6)	76.1	(74.8,77.5)
BMI 25–29.9 (%)	32		47		48		34	
BMI ≥30 (%)	12		12		22		13	
WHR ≥0.95 (%)	24		18		43		25	
Physically active (%)	94		100		96		94	
F/H of DM (%)	6		0		13		6	
Hypertensive (%)	8	(12)	12	(12)	13	(30)	9	(14)
Women								
Number examined	597		59		31		687	
Age (yr)	46.4	(45.5,47.2)	51.80	(49.1,54.5)	55.0	(51.3,58.8)	47.3	(46.4,48.1)
BMI (kg m^{-2})	25.2	(24.8,25.6)	27.3	(25.7,28.8)	27.9	(26.1,29.8)	25.5	(25.1,25.9)
WHR	0.87	(0.86,0.87)	0.91	(0.88,0.93)	0.92	(0.9,0.94)	0.87	(0.87,0.88)
Systolic BP	120.0	(118.3,121)	130.9	(124.2,137.6)	133.1	(126.1,140)	121.5	(119.9,123.1)
Diastolic BP	72.4	(71.5,73.3)	76.9	(73.5,80.4)	78.5	(75.7,81.2)	73.1	(72.2,74)
BMI 25–29.9 (%)	30		41		39		31	
BMI ≥30 (%)	15		24		29		16	
WHR ≥0.95 (%)	14		27		32		33	
Physically active (%)	94		97		97		94	
F/H of DM (%)	4		2		6		4	
Hypertensive (%)	8	(19)	15	(32)	16	(45)	9	(21)

BMI, body mass index; WHR, waist–hip ratio; F/H, family history; DM, diabetes mellitus; Hypertensive, systolic blood pressure ≥160 and/or diastolic blood pressure ≥95. Percentages in parentheses include subjects who were clinically normotensive but who claimed to take antihypertensive therapy.

communities, especially at younger ages. This was due to many of the latter being absent from the village, employed elsewhere, as is not unusual in relatively disadvantaged populations. To aid international comparison, age-standardized prevalence was also calculated for the age range 30–64 years, using the world population of Segi as the standard, as was done in the global prevalence estimates compiled by WHO.[1]

At Tashlak, crude prevalence of diabetes was 9 % in men and 5 % in women ($p < 0.05$, Table 1). Prevalence of IGT was 9 % in women and 6 % in men (NS). The age-standardized prevalence proportions were very similar to the crude estimates. However, after adjusting for non-response, estimated prevalence of diabetes was 5 % in men and 4 % in women, with IGT remaining more common in women (8 % vs 4 %). In Fergana, prevalence of diabetes was 13 % in men and 9 % in women (NS) but when adjusted for non-response, estimated prevalence was 8 % in both sexes. The prevalence of IGT was 9 % in men and 8 % in women (NS) but 5 % in men and 6 % in women when adjusted for non-response.

The frequency of glucose intolerance rose with age, to a peak at 55–64 or 65+ years. Age-specific prevalence was higher in urban than in semirural subjects of both sexes in almost all age groups. In semirural Tashlak, approximately one-half of persons with diabetes were unaware of their condition, but in urban Fergana, a prior diagnosis was recorded in approximately 80 % of cases.

The distribution of 2 h capillary blood glucose concentration is shown in Figure 3. It is evident that the distribution for women is shifted to the right of that for men, the modal values being approximately 1 mmol l^{-1} apart. There was very little difference in the distributions of blood glucose concentration for urban and semirural subjects, the difference in prevalence of diabetes and IGT being accounted for by a relatively small number of subjects in the upper tail of the distribution.

The relation between glucose tolerance status and a number of factors of interest is shown in Tables 2 and 3. Age, body mass, waist–hip ratio and blood pressure were generally highest in subjects with diabetes, intermediate in those with IGT, and lowest in those with normal glucose tolerance. Almost one-half of subjects in both communities had body mass index (BMI) 25 or greater. Central obesity was observed in over one-quarter of subjects in both communities. At Tashlak, the great majority of subjects claimed to be habitually physically active and there was little scope for statistical trend in this variable. In Fergana, approximately 70 % of men

© 1998 John Wiley & Sons, Ltd.

Table 3. Means (95 % confidence interval) and proportions (%) of selected factors in men and women with normal glucose tolerance, impaired glucose tolerance, and diabetes mellitus, in the urban (Fergana) population, Uzbekistan, 1997

Variable	Normal glucose tolerance		Impaired glucose tolerance		Diabetes mellitus		Total	
Men								
Number examined	233		26		38		297	
Age (yr)	52.8	(51.8,53.8)	61.3	(58,64.7)	58.6	(56.5,60.7)	54.3	(52.8,55.8)
BMI (kg m^{-2})	25.0	(24.9,25)	25.4	(23.7,27.2)	27.9	(26.2,29.5)	25.4	(24.8,26)
WHR	0.90	(0.89,0.91)	0.93	(0.9,0.95)	0.95	(0.93,0.97)	0.91	(0.9,0.92)
Systolic BP	128.4	125.6,131)	141.6	(129.6,153.6)	129.7	(124.3,135.2)	129.7	(127.2,132.2)
Diastolic BP	80.0	(78.6,81.5)	85.1	(79.8,90.5)	82.5	(79.3,85.7)	80.8	(79.5,82.1)
BMI 25–29.9 (%)	33		38		34		33	
BMI ≥30 (%)	11		15		32		14	
WHR ≥0.95 (%)	23		27		58		28	
Physically active (%)	73		62		68		72	
F/H of DM (%)	7		15		21		9	
Hypertensive (%)	10	(18)	31	(35)	13	(16)	12	(19)
Women								
Number examined	582		56		69		707	
Age (yr)	51.4	(50.4,52.4)	58.2	(54.9,61.5)	59.3	(57.2,61.5)	52.7	(51.8,53.7)
BMI (kg m^{-2})	27.9	(27.4,28.4)	27.7	(26.4,28.9)	29.9	(28.6,31.3)	28.1	(27.6,28.5)
WHR	0.84	(0.83,0.84)	0.87	(0.85,0.89)	0.92	(0.91,0.94)	0.85	(0.84,0.85)
Systolic BP	125.8	(123.8,127)	138.2	(129.4,147)	142.3	(136,148.6)	128.4	(126.4,130.4)
Diastolic BP	77.7	(76.8,78.6)	80.1	(76.7,83.6)	81.9	(79.2,84.5)	78.3	(77.5,79.1)
BMI 25–29.9 (%)	32		43		39		34	
BMI ≥30 (%)	32		29		42		33	
WHR ≥0.95 (%)	17		30		67		23	
Physically active (%)	57		59		61		57	
F/H of DM (%)	12		18		29		14	
Hypertensive (%)	12	(25)	20	(36)	36	(49)	14	(28)

BMI, body mass index; WHR, waist–hip ratio; F/H, family history; DM, diabetes mellitus; Hypertensive, systolic blood pressure ≥160 and/or diastolic blood pressure ≥95. Percentages in parentheses include subjects who were clinically normotensive but who claimed to take antihypertensive therapy.

and approximately 60 % of women were physically active in each diagnostic category.

In Fergana, family history of diabetes was more frequent in women than men ($p < 0.05$) and was positively related to glucose intolerance in both sexes, subjects with IGT having an intermediate value.

Mean age was higher in urban than in rural subjects ($p < 0.01$). For men, means and proportions were generally similar for semirural and urban subjects. Urban women had higher mean BMI ($p < 0.01$) but lower mean WHR ($p < 0.001$) than semirural women. Urban women had higher frequency of positive family history of diabetes ($p < 0.001$), higher mean systolic blood pressure ($p < 0.01$), and higher prevalence of clinical hypertension ($p < 0.05$) than semirural women. Clinical hypertension was not particularly common (9 % in semirural men, 14 % in urban men) but prevalence of hypertension rose substantially (14 % in semirural men, 28 % in urban women) when normotensive subjects claiming to be receiving antihypertensive treatment were taken into account.

Age trends for several factors are shown in Figure 4. Blood glucose concentration increased with age in both sexes. In both sexes, body mass index rose from the youngest age group, but there was little decline at the older age groups. Waist–hip ratio continued to increase throughout the age range, especially in women. Whereas systolic blood pressure increased modestly with age (more so in women than men), the curve for diastolic blood pressure is notably flat.

Multiple linear regression models were used to predict subjects' 2-h capillary blood glucose concentration on the basis of the factors of interest. For both men and women, place of residence (semirural or urban), WHR and age were highly significant predictors ($p < 0.001$), whereas BMI, systolic and diastolic blood pressures were not significant (data not shown).

A total of 141 subjects in the two surveys had a prior diagnosis of diabetes. Of these, 55 % were treated with oral hypoglycaemic agents and 8 % used insulin; 18 % claimed to use herbal therapies, with or without other medication; 13 % relied on diet alone and 11 % were untreated.

Figure 5 shows the coexistence of the principal factors of interest—glucose intolerance (diabetes and IGT combined), central obesity and hypertension—in survey responders. At both Tashlak and Fergana, one or more of these conditions was present in approximately 30 % of all subjects. The most frequent condition was central obesity, being present in approximately 20 % in both

© 1998 John Wiley & Sons, Ltd.

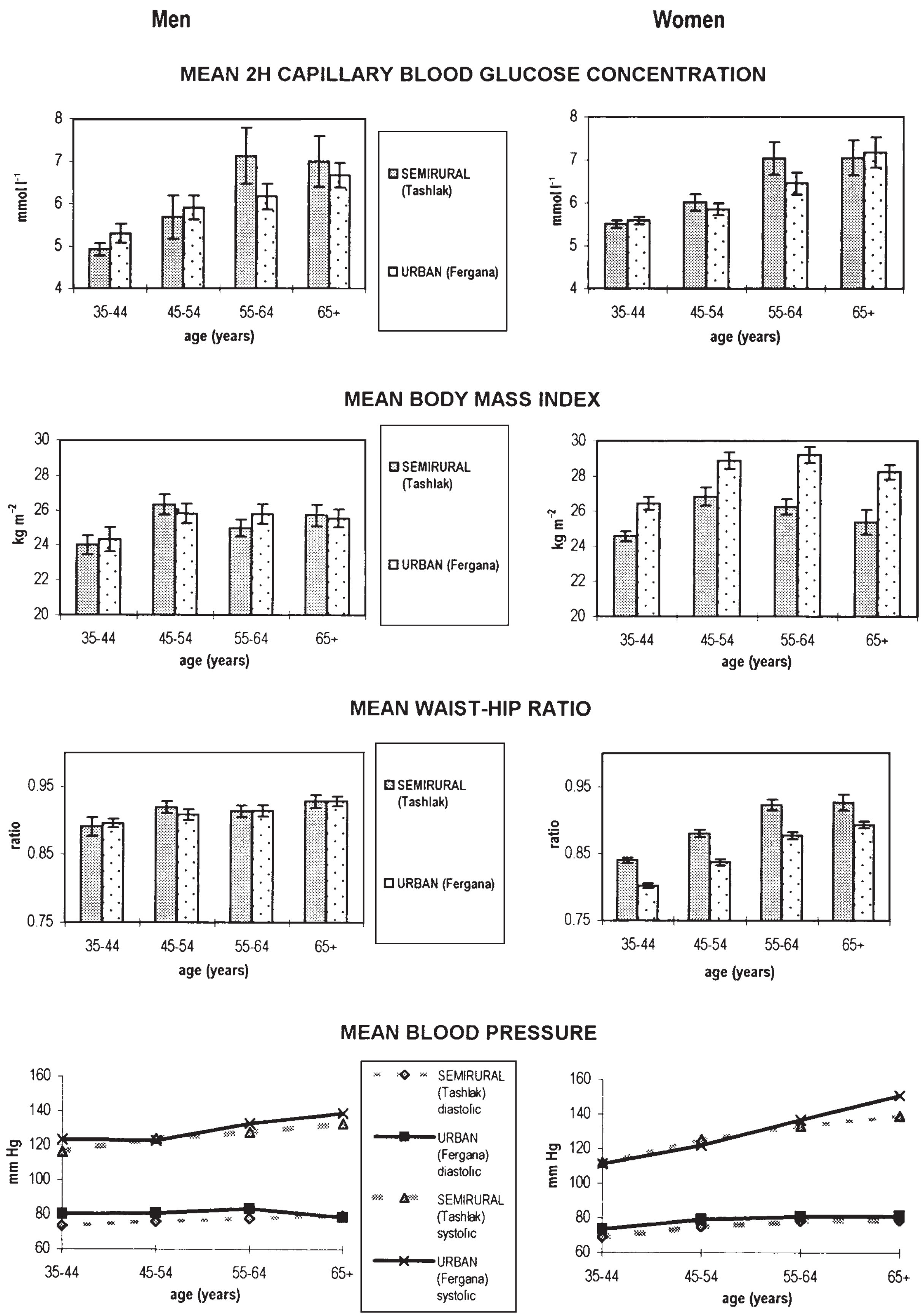

Figure 4. Relation between age and blood glucose concentration, body mass index, waist–hip ratio and blood pressure, Fergana Valley, Uzbekistan, 1996–97. Vertical bars represent 95 % confidence intervals

© 1998 John Wiley & Sons, Ltd.

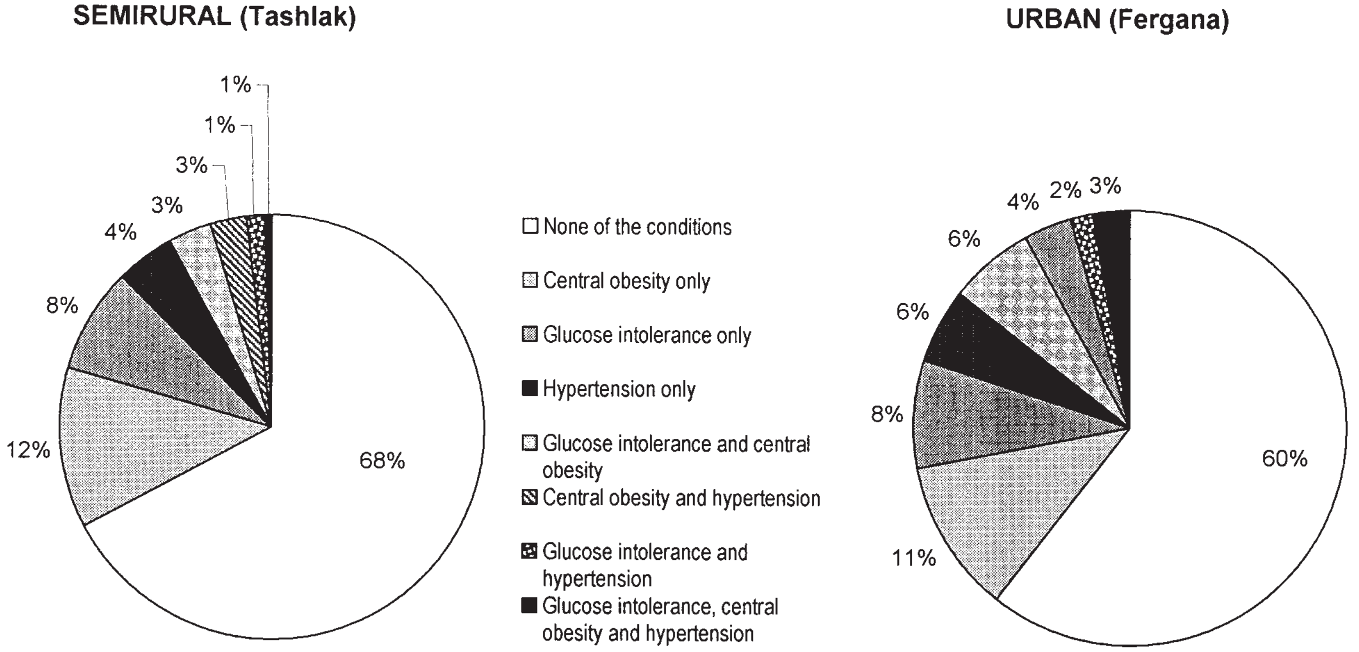

Figure 5. Coexistence of glucose intolerance (diabetes and impaired glucose tolerance), central obesity and hypertension, Fergana Valley, Uzbekistan, 1996–97

samples, and being complicated by glucose intolerance and hypertension in 3–6 % in each case. Isolated glucose intolerance and hypertension were found in 8 % and 4 %, respectively, in Tashlak, and in 8 % and 6 % in Fergana. The combination of glucose intolerance and hypertension was observed in only 1 % in Tashlak and 2 % in Fergana. All three conditions were demonstrated in a further 1 % at Tashlak and 3 % in Fergana.

Although the majority of subjects surveyed were Uzbek, 12 % of men and 23 % of women were apparently of Russian ethnicity, according to their family name. This was considered locally to be a reliable indicator. Russian men and women had a higher prevalence of diabetes than their Uzbek counterparts (Figure 6). Russian men had lower mean BMI and waist–hip ratio than Uzbek men, but the prevalence of hypertension was comparable in the two groups. However, Russian women had higher mean BMI and WHR, and higher prevalence of hypertension, than the Uzbek women. Given the small sample size of the Russian subgroups, most of the differences failed to reach statistical significance.

Discussion

A survey conducted by the Institute of Endocrinology of the Academy of Science of Uzbekistan in several centres throughout the Republic during the period 1985–90 suggested that diabetes was not a common disorder, with a prevalence of approximately 2 % (Y. Tourakulov, personal communication). Our 1996–97 surveys indicate that glucose intolerance and central obesity are now common in the Fergana Valley. However, hypertension was not frequent by international standards, and there was little evidence of a rise in blood pressure with age.

A previous study of noncommunicable diseases was conducted in the Ristan region of the Fergana Valley in the early 1990s.[5] Glucose tolerance was assessed in a small subsample of 235 subjects aged 20–59 years, using a 75 g oral glucose challenge. Abnormal glucose tolerance was diagnosed if the blood glucose concentration was greater than 5.6 mmol l^{-1} (100 mg dl^{-1}) in the fasting state, 10.0 mmol l^{-1} (180 mg dl^{-1}) at 1 h or 7.2 mmol l^{-1} (130 mg dl^{-1}) at 2 h after the glucose challenge. These values may be taken as a crude approximation to the WHO criteria for impaired glucose tolerance (a 2-h value of 7.8 mmol l^{-1}). According to these criteria, glucose intolerance was observed in 14 % of subjects, which is almost the same as our adjusted estimate for IGT and diabetes combined in Fergana city.

The fact that prevalence of diabetes was relatively high in the 45–64 year age range is important for future health service planning, since an increasing proportion of the population will enter this range as ageing of the population occurs. Recent WHO estimates, based upon the survey data presented in this report, suggest that there are currently approximately 350 000 adults with diabetes in Uzbekistan, but that the figure will almost triple, to approximately 1 million by the year 2025.[6]

The ratio of prevalence of IGT and diabetes has been suggested as an index of the epidemicity of glucose tolerance in a population.[7] On this basis, a further rise in the prevalence of diabetes could be expected in the semirural women, in whom IGT was twice as prevalent as diabetes.

The great changes presently occurring in the ex-Soviet republics, and the economic difficulties which are besetting most of them, are affecting their demography. In particular, young males are becoming very mobile,

© 1998 John Wiley & Sons, Ltd.

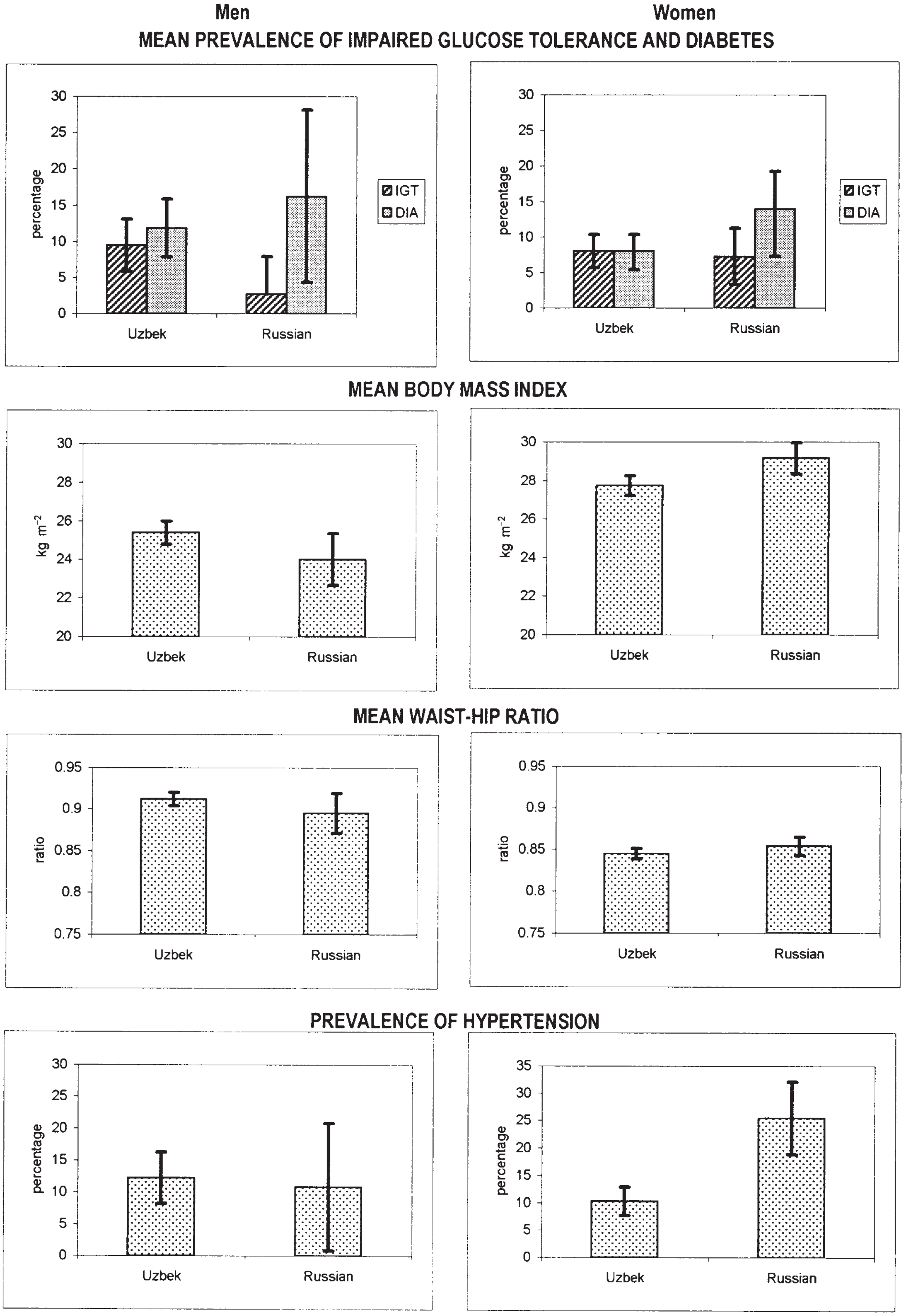

Figure 6. Prevalence of diabetes, impaired glucose tolerance and hypertension, and mean body mass index and waist–hip ratio in subjects of Uzbek and Russian ethnicity, Fergana city, Uzbekistan, 1997

© 1998 John Wiley & Sons, Ltd.

with long absences from home, in their attempt to find employment and to trade. This tendency is evident in the present study population, with younger males being under-represented in the eligible populations of the two communities. Young males also had lower response rates, since many of those listed as resident at the time of the census were absent at the time of the survey. Our decision to adjust for non-response by including all such subjects in the denominator may be considered contoversial, but it was taken on the basis that they are true members of the communities studied, and that being young and active, they are unlikely to have glucose intolerance. In this sense, they provide a conservative estimation. This leads us to believe that examination of the effect of such adjustment for non-response might be prudent in situations in which a significant proportion of males of working age are unable to attend the survey.

Our response-adjusted prevalence is comparable with estimates for Pakistan of 5 % in rural Baluchistan (A.S. Shera, personal communication) and 12 % in urban subjects in Sindh Province.[8] Central Asian populations may share, to some degree, the susceptibility to glucose intolerance which is a feature of the populations of the Indian subcontinent.[1]

In the present study, many of the variables examined were distributed similarly in semirural and urban subjects, especially in men. From this it may be concluded that Tashlak was not a traditional rural community. The very high self-reported levels of physical activity cast doubt on the validity of our activity scale, especially in the presence of a high frequency of overweight and central obesity. The latter may be explained by the typical Uzbek diet, which in both rural and urban settings contains a high proportion of meat and animal fat.

The significance of WHR, but not of BMI, in predicting subjects' capillary glucose concentration in the regression models confirms that central obesity, rather than body mass, is the relevant factor. For women, an apparently surprising observation is that mean WHR was higher in semirural than in urban subjects. However, the semirural women had a mean of 5.6 live births each, compared to 3.5 for the urban women. Centrally obese women had a higher mean number of live births than non-centrally obese women in both communities (6.9 vs 5.0 in Tashlak, 4.5 vs 3.2 in Fergana).

Clinical hypertension was not particularly common by international standards, unless a history of antihypertension was taken into account. However, it was not possible to validate the accuracy of such a history, or the regularity or adequacy of the treatment.

The proportion of persons with diabetes who were previously diagnosed was notably high (80 %) in Fergana and this probably represents the effect of regular screening programmes which occurred during Soviet times.

The high prevalence of diabetes in subjects of Russian ethnicity is interesting. Prevalence in Fergana Russians (16 % in men and 14 % in women) was far higher than that reported from a study conducted in Novosibirsk, Siberia, in 1988 (2 % in men and 4 % in women) which used comparable methodology.[1] However, our finding should be treated with caution, since response rates were not calculated separately for the Russian subgroup.

Taken as a whole, the results indicate that diabetes and other noncommunicable diseases are already a significant public health problem in this region of Central Asia. However, the Fergana Valley is part of a large and varied region and further studies would be required to obtain a complete picture of diabetes epidemiology in Uzbekistan and the other republics of Central Asia. Much of Uzbekistan is agriculturally fertile and food is relatively plentiful. Our data suggest a dietary origin for the detected overweight and obesity. Thus, there is likely to be value in a community awareness programme highlighting the nature and usefulness of a healthy diet and adequate exercise.

Note: The conduct of these surveys provided the opportunity to develop a standardized survey questionnaire and a computer software program for data entry, validation, and analysis, the output from which may be used to create tables and figures similar to those presented in this report. The program is available, free of charge, from the corresponding author.

Acknowledgements

The Fergana diabetes surveys were first proposed by Sh. Karimov, Minister of Health, Republic of Uzbekistan. They were made possible by co-operation between the WHO Headquarters Diabetes Programme, the Ministry of Health of Uzbekistan, and the Novo Nordisk Regional Offices for Middle East and Africa, Athens, Greece (particularly Mr A. Elphick) and for Central Asia, Tashkent, Uzbekistan. The following made important contributions to the planning and conduct of the surveys: Kh. Kh. Kodjyrakhmatov, M.M. Muminov, Sh. Y. Khusanbaev, T.M. Makhmudov and M.A. Tashmatova (Ministry of Health of Uzbekistan), and N. Platonova (Novo Nordisk, Tashkent).

References

1. King H, Rewers M. WHO Ad Hoc Diabetes Reporting Group. Global estimates for prevalence of diabetes mellitus and impaired glucose tolerance in adults. *Diabetes Care* 1993; **16**: 157–177.
2. World Health Organization. *Demographic Data for Health Situation Assessment and Projections—1996*. WHO/HST/HSP/96.3. Geneva: WHO. 1996.
3. Dean AG, Dean JA, Burton AH, Dicken RC. *Epi Info, Version 5: a Word Processing, Database, and Statistics Program for Epidemiology on Microcomputers*. USD, Inc., Stone Mountain, Georgia, USA, 1990.
4. WHO Study Group. *Prevention of Diabetes Mellitus: Report of a WHO Study Group*. Technical Report Series no. 844. Geneva: WHO. 1994.
5. Sadikov UT. Impaired carbohydrate tolerance and hyper-

© 1998 John Wiley & Sons, Ltd.

uricaemia as risk factors for the main chronic noncommunicable diseases in the working rural population of Fergana Valley, Uzbekistan. Abstract of a dissertation for the degree of Candidate of Medical Sciences. Bishkek: Kyrgyz Institute of Cardiology, 1993 (in Russian).
6. World Health Organization. *World Health Report 1997. Conquering Suffering, Enriching Humanity*. Geneva: WHO, 1997: 153.
7. Dowse G, Zimmet P, King H. Relationship between prevalence of impaired glucose tolerance and NIDDM in a population. *Diabetes Care* 1991; **14**: 968–974.
8. Shera AS, Rafique G, Khwaja IA, Ara J, Baqai S, King H. Pakistan National Diabetes Survey: Prevalence of glucose intolerance and associated factors in Shikarpur, Sindh Province. *Diabetic Med* 1995; **12**: 1116–1121.

© 1998 John Wiley & Sons, Ltd.